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Claims

1. A photonic crystal fibre comprising a region of substantially uniform, lower refractive index which is substantially surrounded by cladding which includes regions of higher refractive index and which is substantially periodic, characterised in that the region of lower refractive index has a longest transverse dimension which is longer than a single, shortest, period of the cladding, whereby light can be substantially confined in the lower index region by virtue of a photonic band gap of the cladding material and can be guided along the fibre whilst it is so confined.
2. A photonic crystal fibre, as claimed in claim 1, in which the region of lower refractive index comprises a gas or a vacuum.
3. A photonic crystal fibre, as claimed in claim 1 or claim 2, in which the substantially periodic cladding material has a triangular lattice structure.
4. A photonic crystal fibre, as claimed in claim 3, in which the triangular lattice comprises air holes in a solid matrix.
5. A photonic crystal fibre, as claimed in any preceding claim, in which the regions of higher refractive index consist essentially of silica.
6. A photonic crystal fibre, as claimed in any preceding claim, in which the fraction of air in the cladding is at least 15% by volume based on the volume of the cladding.
7. A photonic crystal fibre, as claimed in claim 6, in which the region of the lower refractive index comprises air.

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8. A photonic crystal fibre, as claimed in any preceding claim in which the region of lower refractive index is a low-pressure region.

5 9. A photonic crystal fibre, as claimed in any preceding claim, in which the lower index region comprises a material having a non-linear optical response, whereby light may be generated by non-linear processes in the lower-index region.

10 10. A photonic crystal fibre comprising a region of substantially uniform, lower refractive index which is substantially surrounded by cladding which includes regions of higher refractive index and which is substantially periodic, characterised in that the region of lower refractive index is large enough to support at least one transverse mode.

15 11. A photonic crystal fibre as claimed in claim 10, which is a single-mode fibre.

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12. An optical device, including photonic crystal fibre according to any preceding claim.

20 13. An optical device, as claimed in claim 12, comprising a spectral filtering device.

14. An optical device, as claimed in claim 12, comprising an optical amplifier.

25 15. An optical device, as claimed in claim 12, comprising a laser.

16. An optical device, as claimed in claim 12, comprising a sensor that is capable of sensing a property of the gas of which the region of lower refractive index is comprised.

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17. A telecommunications system, including a photonic crystal fibre according to any of claims 1 to 11.

18. A telecommunications system, including an optical device according to any of claims 12 to 16.

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19. ~~A telecommunications network including a telecommunications system according to any of claims 17 to 18.~~

20. A method of making a photonic crystal fibre,
5 comprising the following steps:

(a) forming a stack of canes, the stack including at least one truncated cane which defines a cavity in the stack;

(b) drawing the stack into a fibre having an elongate cavity.

10 21. A method, as claimed in claim 20, in which the optical fibre is a fibre according to any one of claims 1 to 8 or 10 to 11.

15 ~~22. A method, as claimed in claim 20 or 21, in which the cavity has a transverse dimension greater than the corresponding transverse dimension of any of the canes.~~

23. A method, as claimed in claim 22, in which the cavity has a transverse dimension greater than the sum of the corresponding dimensions of any two of the canes.

20 ~~24. A method, as claimed in any of claims 20 to 23, in which the stack of canes comprises canes which are capillaries.~~

25 25. A method, as claimed in claim 24, in which the capillaries form a triangular array.

~~26. A method, as claimed in claim 24 or claim 25, in which the capillaries are filled with a material other than air.~~

30 27. A photonic crystal fibre made by a method as claimed in any of claims 20 to 26.

28. A method of making a photonic crystal fibre substantially as described herein, with reference to the drawings.

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29 A photonic crystal fibre substantially as described herein, with reference to the drawings.

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~~30 A method of transmitting light along a photonic crystal fibre, the fibre being a fibre as claimed in any of claims 1 to 12.~~

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